AFSWC-TR-71-10

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MHU-79/C CLIP-IN STATIC TESTING

Mahlon E. Traylor, Jr.

AIR FORCE SPECIAL WEAPONS CENTER
Air Force Systems Command
Kirtland Air Force Base
New Mexico

TECHNICAL REPORT NO. AFSWC-TR-71-10

March 1971

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FOREWORD

This research was performed under Program Element 62601F, Project 5704.

Inclusive dates of testing were 9 September 1970 through 10 December 1970. The report was submitted 8 February 1971 by the Air Force Special Weapons Center Test Director, Mr. Mahlon E. Traylor, Jr. (FTSE). The Air Force Weapons Laboratory Project Officer was Mr. Edward J. Kobiela (SYX).

This technical report has been reviewed and is approved.

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ABSTRACT

(Distribution Limitation Statement No. 3)

The MHU-79/C Clip-in was designed to carry nine 18-inch diameter stores or a smaller number of larger stores in a variety of combinations in the bomb bay of the B-52 aircraft. The MHU-79/C passed static testing to specifications furnished by the Air Force Weapons Laboratory.

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SECTION I

TEST ITEM

The MHU-79/C Clip-in is designed to fit any of the MHU-6/A positions within the bomb bay of the B-52 aircraft. The clip-in is unique in that it has the capability of carrying as many as nine 18-inch diameter stores. This capacity is made possible by the insertion, into its inverted "U" conformation, a partition which carries D-7 type bomb shackles as do the sides of the "U." When this partition is removed, a smaller number of stores of a larger diameter may be carried in a variety of combinations. The clip-in, with the center partition installed weighs 3,830 pounds and its center of gravity is 29-5/8 inches aft of its forward edge. The MHU-79/C sits on the ADU-333/E Adapter Pan for transport on a weapons handling trailer. The MHU-79/C and ADU-333/E, in combination, weigh a total of 4,870 pounds and their combined center of gravity is 28-3/4 inches aft of the forward edge. The combination with nine stores installed is illustrated on a weapons handling trailer in figure 1.

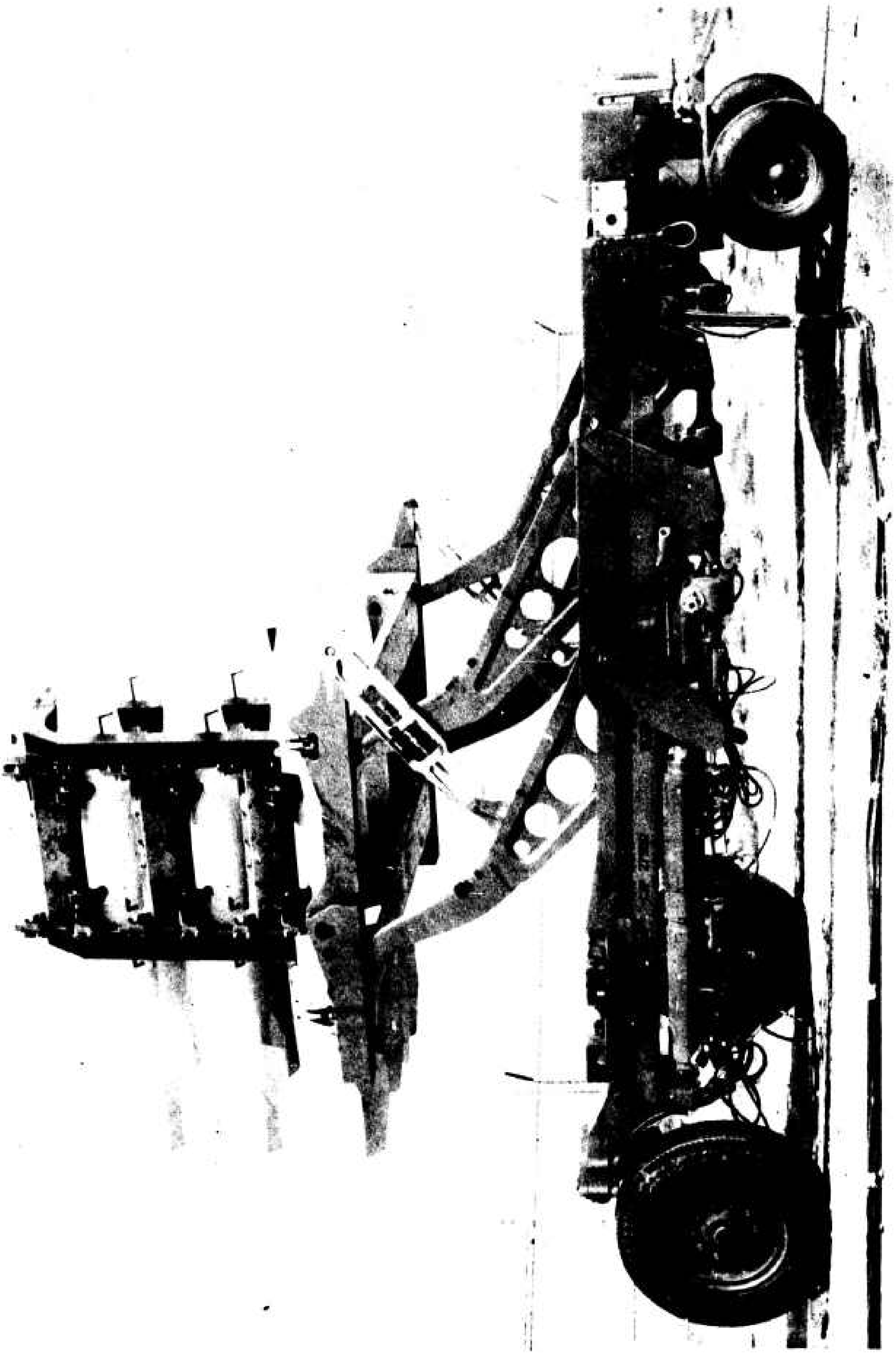

Figure 1. MHU-79/C and ADU-333/E on Munitions Handling Trailer

SECTION II

TEST PROCEDURES AND RESULTS

1. ADU-333/E ADAPTER PAN

The design load for each of the four locations upon which the clip-in sits on the ADU-333/E adapter pan is 11,250 pounds. The test requirement was to load each of these four locations to 150 percent of the design load, or 16,875 pounds per location. Transport hook span for the front end of the adapter pan was specified to be 98-1/8 inches. The required total of 67,500 pounds was applied to the adapter by applying a force to a symmetrically fabricated "H" frame with a single hydraulic cylinder as illustrated in figure 2. Strain gages were located on the pan as illustrated schematically in figure 3. Deflection gages were also placed under both the front and rear members of the pan at the center line. Visual evidence of the deflection experienced at the forward end of the ADU-333/E is provided in figure 4. Deflection data recorded during incremental application of the specified load are plotted in figure 5. Strain gage data are plotted in figure 6.

Examination of the plots shows that behavior of the test item approximated linear elasticity up to about two thirds of the maximum load (design load). Ultimate load, however, caused some permanent set in the material at the locations of instrumentation.

2. MHU-79/C CLIP-IN

The simultaneously imposed loads on each of nine 3,000 pound, 18-inch diameter stores which the clip-in was designed to withstand, but which are far in excess of the ability of the aircraft to withstand, were:

a. 3.5 g down and 1.5 g left

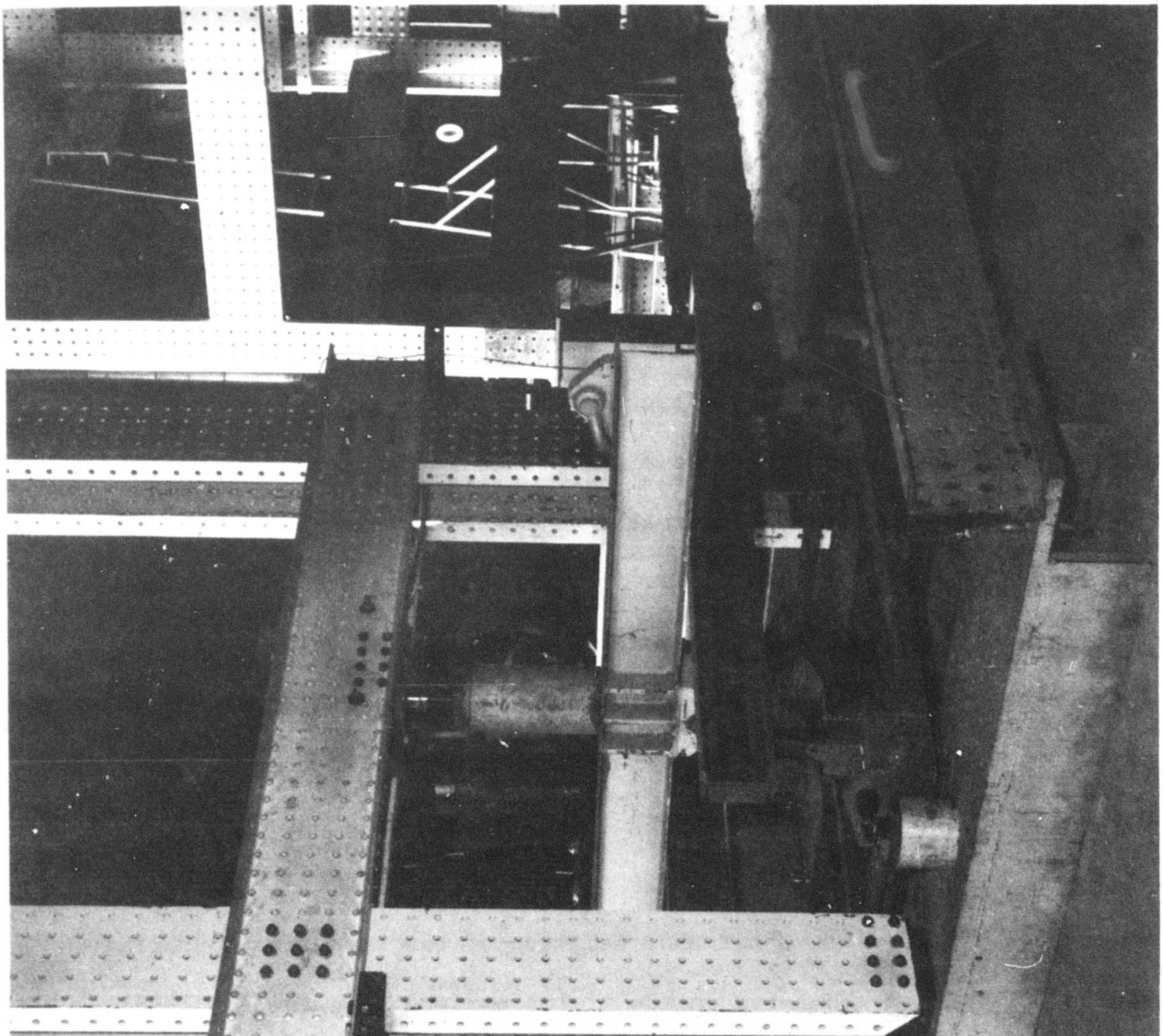

Figure 2. ADU-333/E Test Setup

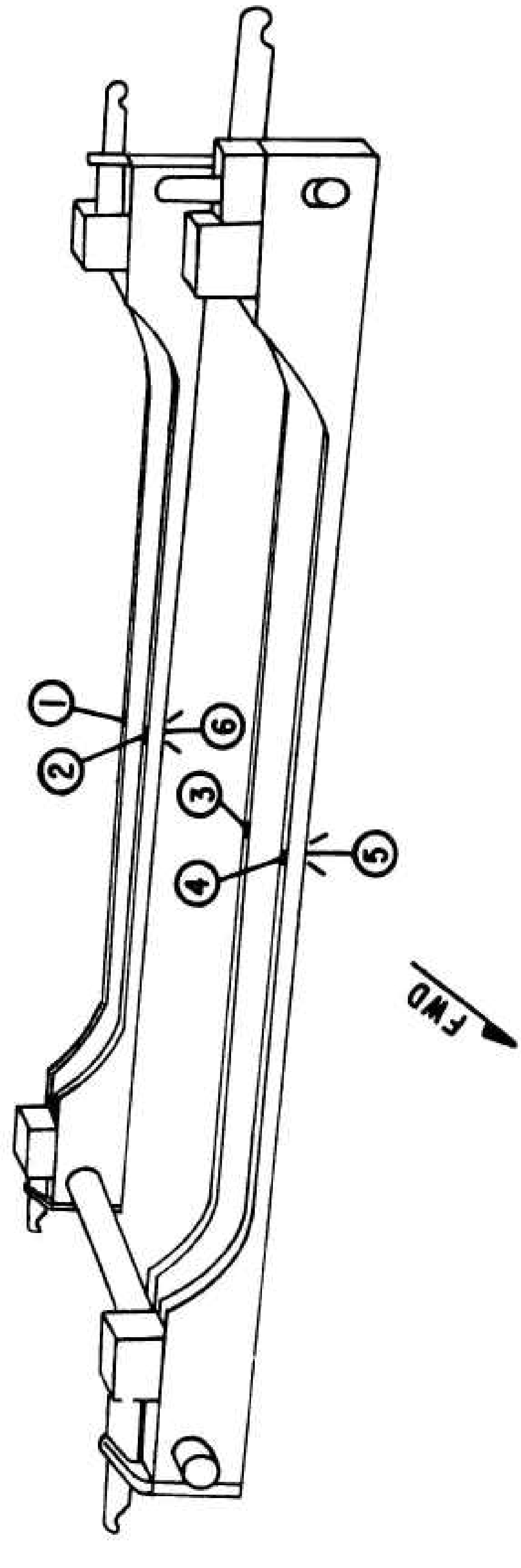

Figure 3. Strain Gage Locations

Figure 4. ADU-333/E Deflection at Ultimate Load

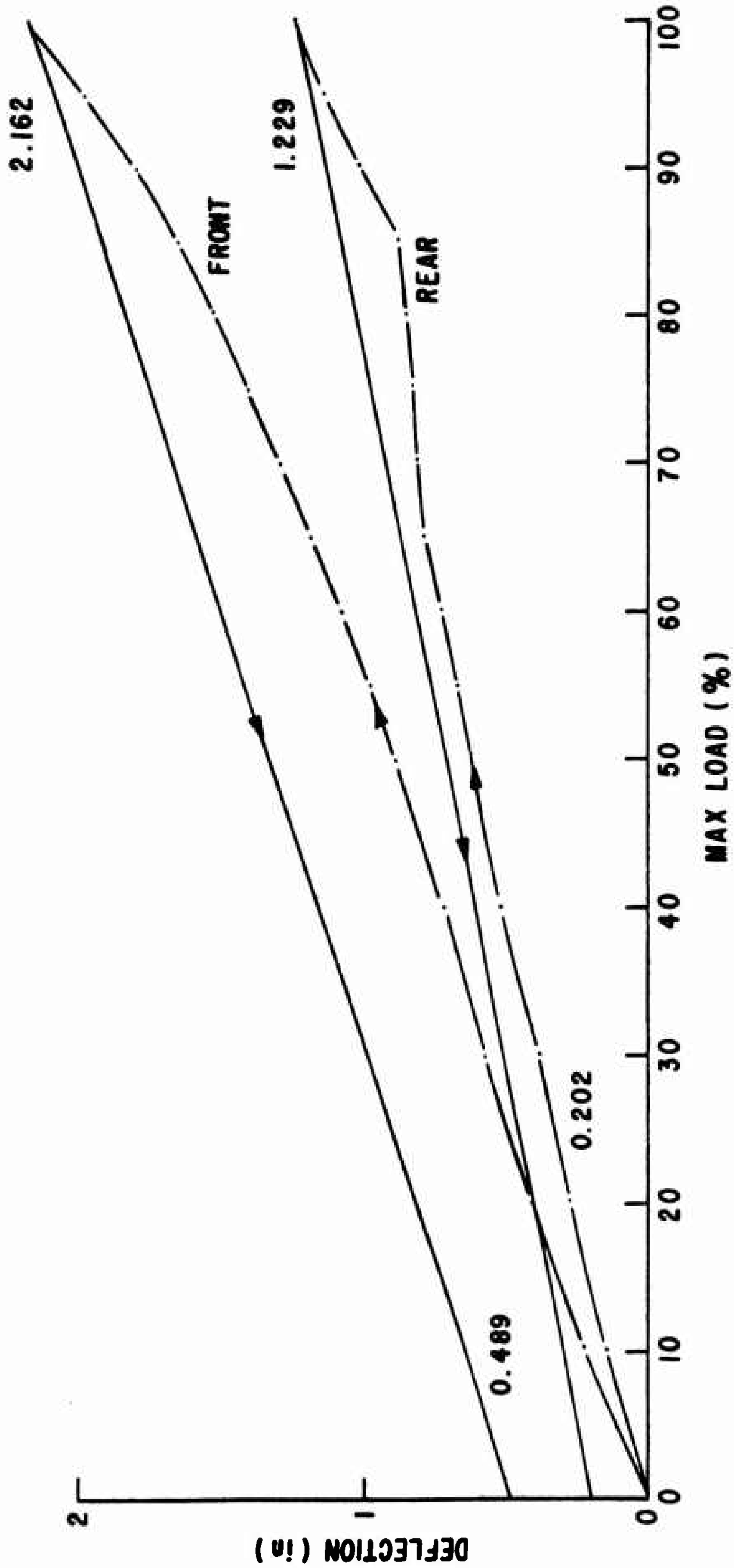

Figure 5. ADU-333/E Deflection Data

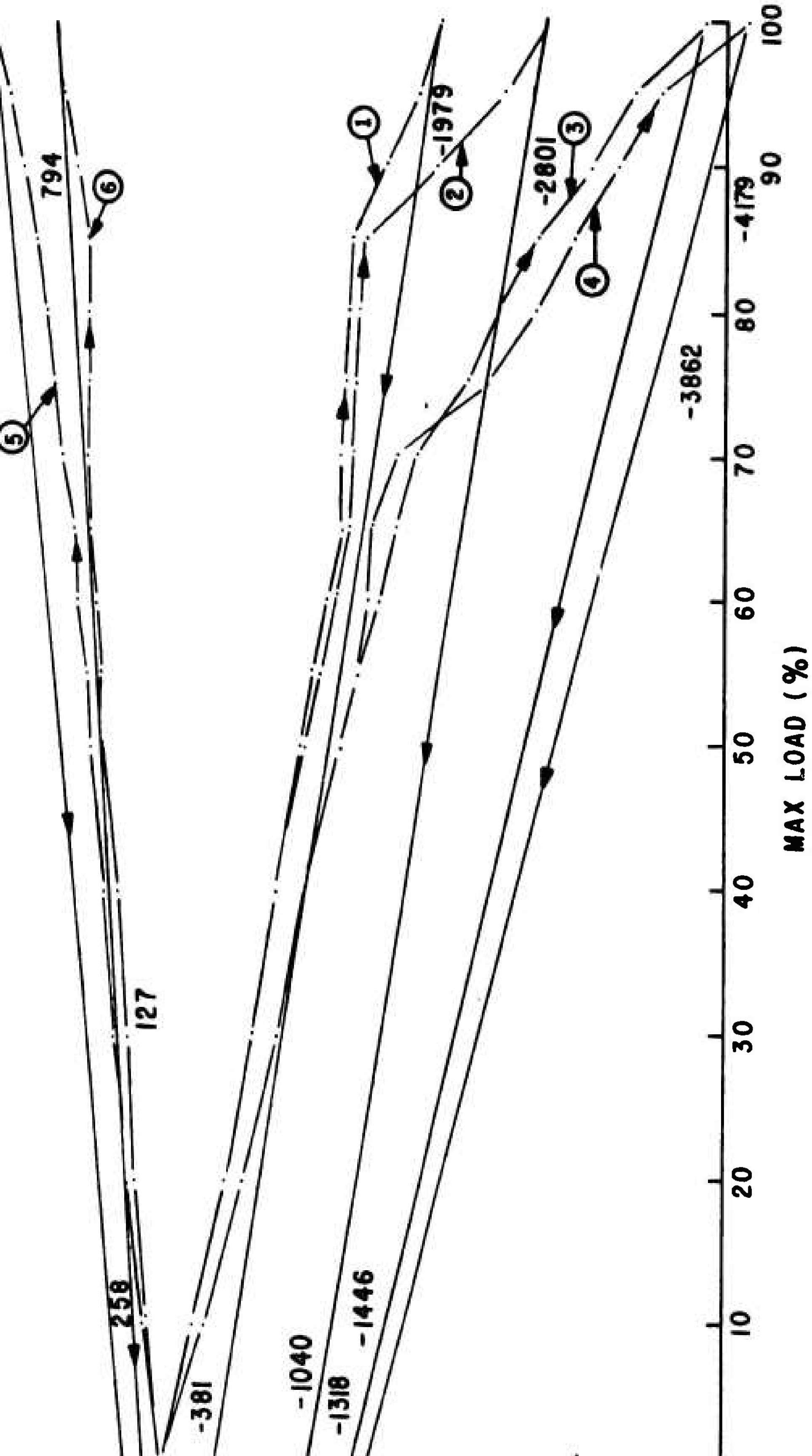

Figure 6. ADU-333/E Strain Gage Data

b. 5.5 g down

c. 3.5 g down and 1.5 g forward

The test specifications called for first applying the above loads, in turn, at the yield load values (115 percent of the design loads) and then at the ultimate load values (150 percent of the design loads). When calculated, the test consisted of the application of a series of six loading conditions wherein each of the stores were to be simultaneously loaded externally as follows (dead weight of stores deducted):

Cond'n 1. 9,075 pounds down and 5,175 pounds left (yield load).

Cond'n 2. 15,975 pounds down (yield load).

Cond'n 3. 9,075 pounds down and 5,175 pounds forward (yield load).

Cond'n 4. 12,750 pounds down and 6,750 pounds left (ultimate load).

Cond'n 5. 21,750 pounds down (ultimate load).

Cond'n 6. 12,750 pounds down and 6,750 pounds forward (ultimate load).

To accomplish the above tasks, nine dummy stores had to be fabricated. These were made of 18-inch diameter pipe whose length was 8 feet and whose wall thickness was just under 1 inch. Holes were drilled and tapped at the appropriate locations in the lengths of pipe to accept standard 30-inch type bomb lugs. The pipes were then filled with concrete to bring their dead weight up to the required 3,000 pounds. Two of these dummy stores were weighed after the concrete had cured for 1 week. One of the two which were picked at random weighed 2,985 pounds and the other weighed 3,020 pounds. The other seven stores were not weight checked. The nine dummy stores can be seen hanging, with no lateral support, in their proper positions in the MHU-79/C Clip-in in figure 7. Because of limited space and rack interference, they were extremely difficult to load into the clip-in.

Prior to the loading of the stores, strain gages were located at the following positions:

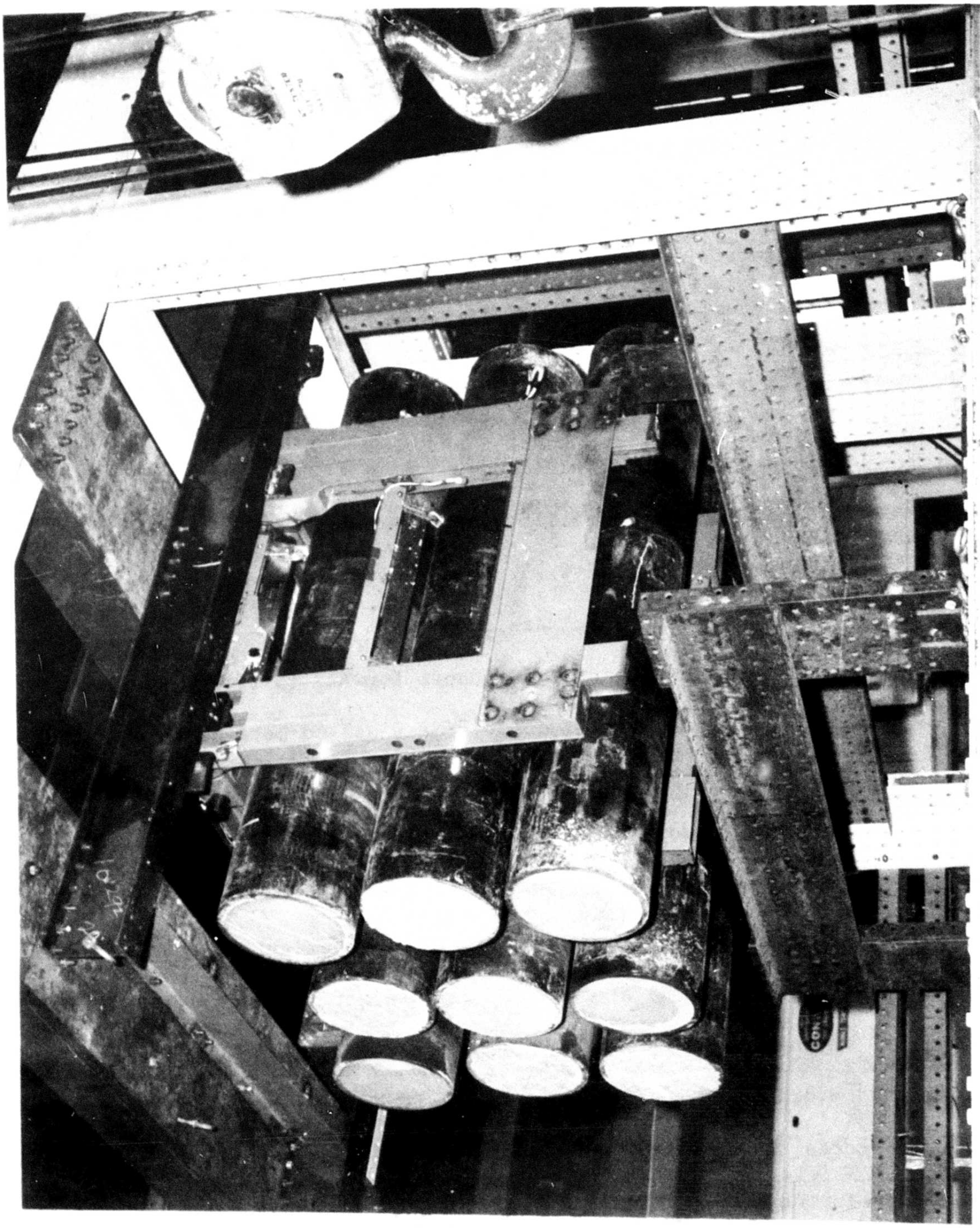

Figure 7. Dummy Stores

Gage No.	Location
1	Back fillet on the left leg at the rear of the clip-in.
2	Forward fillet on the left leg at the rear of the clip-in.
3	Fillet on the left leg at the front end of the clip-in.
4	Back fillet on the rear of the center partition.
5	Forward fillet on the rear of the center partition.
6	Back fillet on the front of the center partition.
7	Forward fillet on the front of the center partition.
8	Back fillet on the right leg at the rear of the clip-in.
9	Forward fillet on the right leg of the rear of the clip-in.
10	Fillet on the right leg at the front of the clip-in.
11	Top center of the right middle shackle support.
12	Bottom edge of the left middle shackle support.
13	Top center of the left middle shackle support.
14	Bottom edge of the right middle shackle support.

Further instrumentation consisted of placing displacement gages to record the excursion of the bottom of the front legs of the clip-in. Deflection was measured in the lateral direction for conditions 1, 2, 4 and 5. Longitudinal deflection was recorded for conditions 3 and 6.

To apply the calculated static loads, a large structural steel static test frame was employed. Affixed to the frame and in line with the points of resultant load application were hydraulic cylinders. Pressures in these cylinders were controlled by technicians at a hydraulic control console. Carefully calibrated load cells were placed in series with the hydraulic cylinders and connected directly to electronic readout gages. These gages were bridge-balanced in such a manner as to enable each technician to set his cylinder pressure in terms of percent of total load. In this way, accurate control of incremental application of force was maintained. Constant cross-check between cylinder pressure gages

and electronic strain readings provided constant correlation to indicate any possible discrepancies in the test setup and procedures. Close-up monitoring of this potentially hazardous test was performed on closed circuit video tape.

The MHU-79/C Clip-in provided a unique challenge to this type of testing in that so many loads were required simultaneously on so many stores. The whiffle-tree principle, as illustrated in figure 8, was employed for all of the down and side loads wherever possible (because of space and equipment limitations). Down loads on the upper layer were applied in compression from above. All forward loads were applied as illustrated in figure 9.

Figures 10 through 15 are plots of the deflections at the bottom of the front legs of the clip-in for each respective loading condition. The amount of permanent set represented by these deflections is tabulated and summed in table I. These measurements were obtained after all external loads had been returned to zero.

During the actual application of the static loading, there was some concern as to how much of the deflection readings could be attributed to the test item and how much could be caused by some minor deflections within the static test frame itself. After having disassembled the test setup an attempt was made to mate the MHU-79/C Clip-in with its ADU-333/E adapter Pan. The front legs of the clip-in had been spread approximately 1-3/8 inches farther apart than when it had fit the pan properly. When this figure is compared with the sum of the right- and left-leg totals of table I (0.430 + 0.806 = 1.236), it becomes quite obvious that if there were any strain in the static test frame, it certainly was of a negligible magnitude.

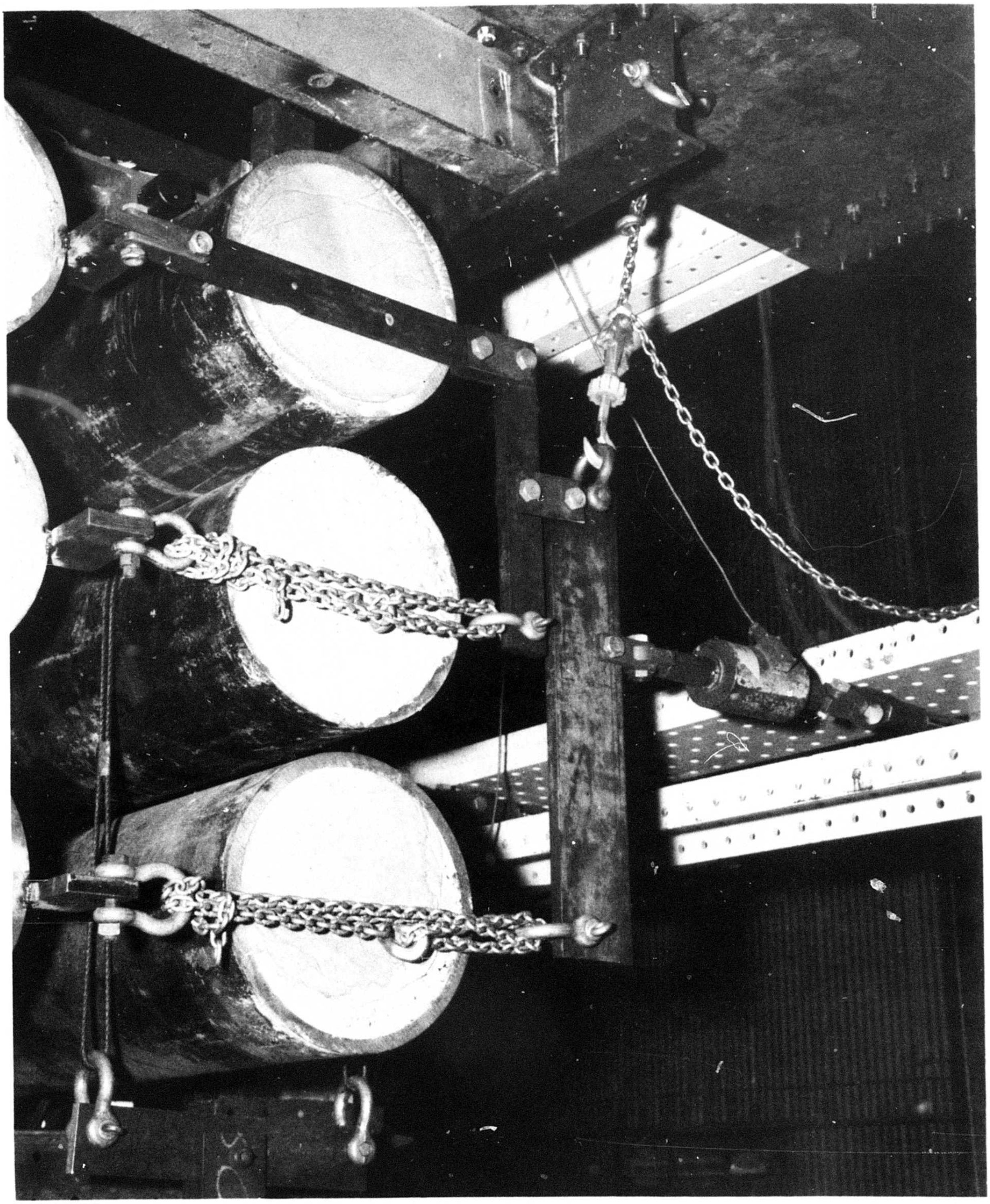

Figure 8. Whiffletree

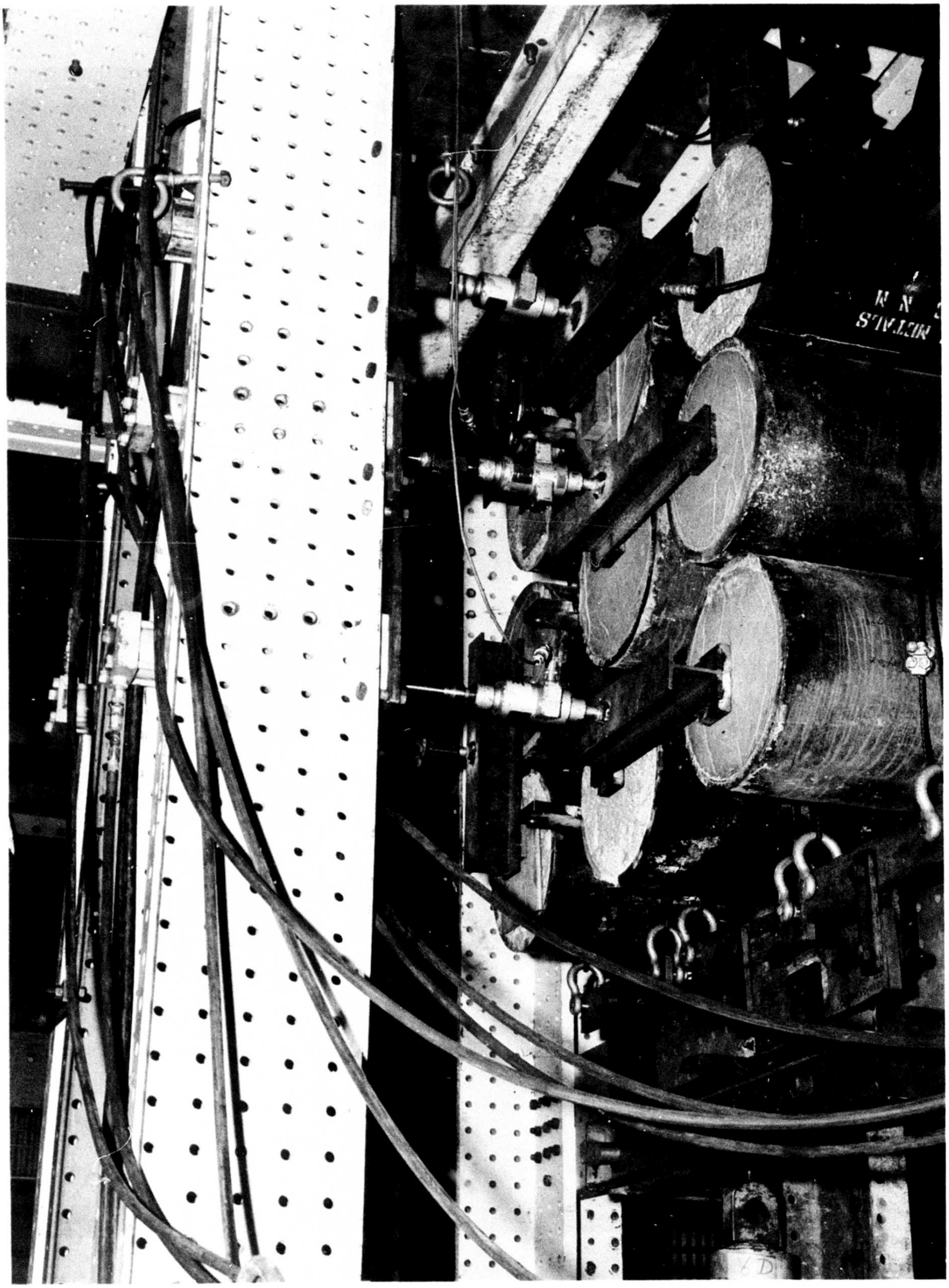

Figure 9. Forward Loads

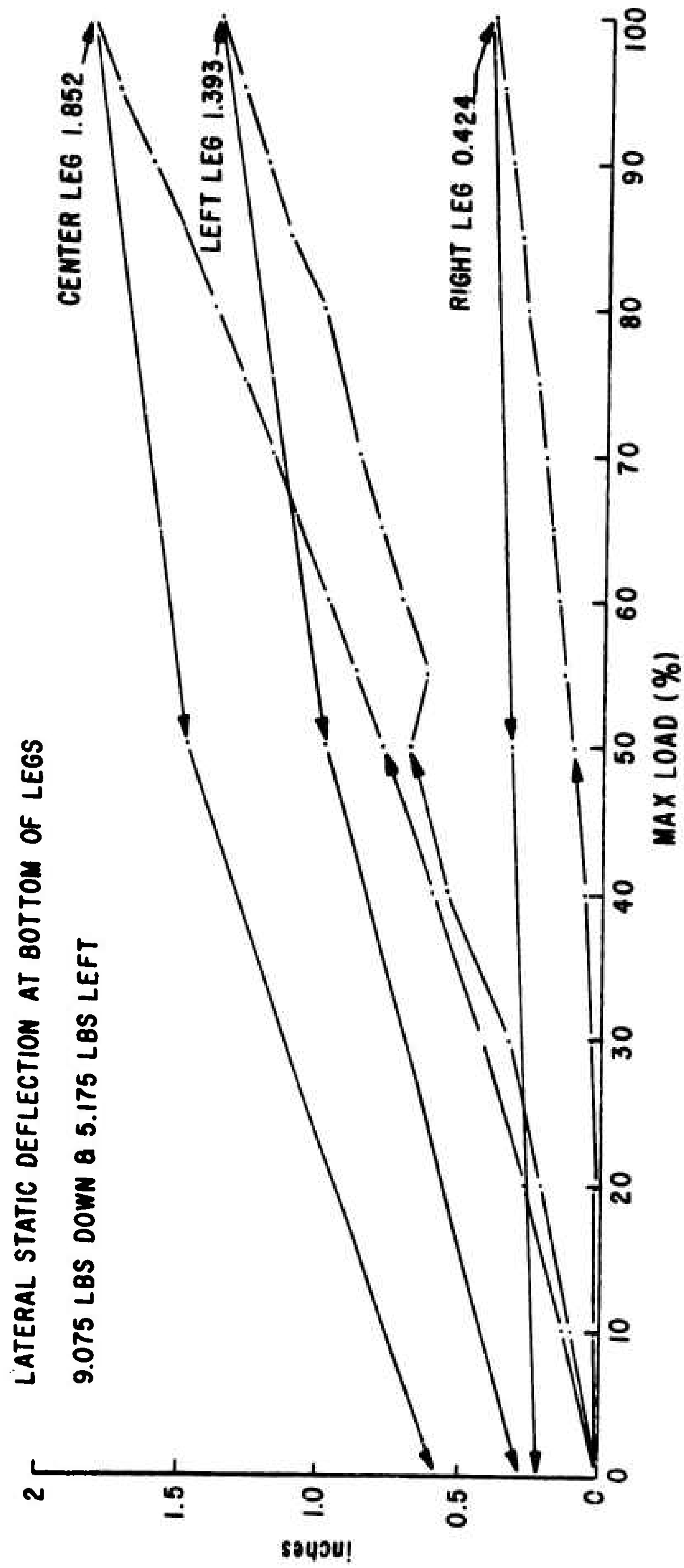

Figure 10. Condition No. 1

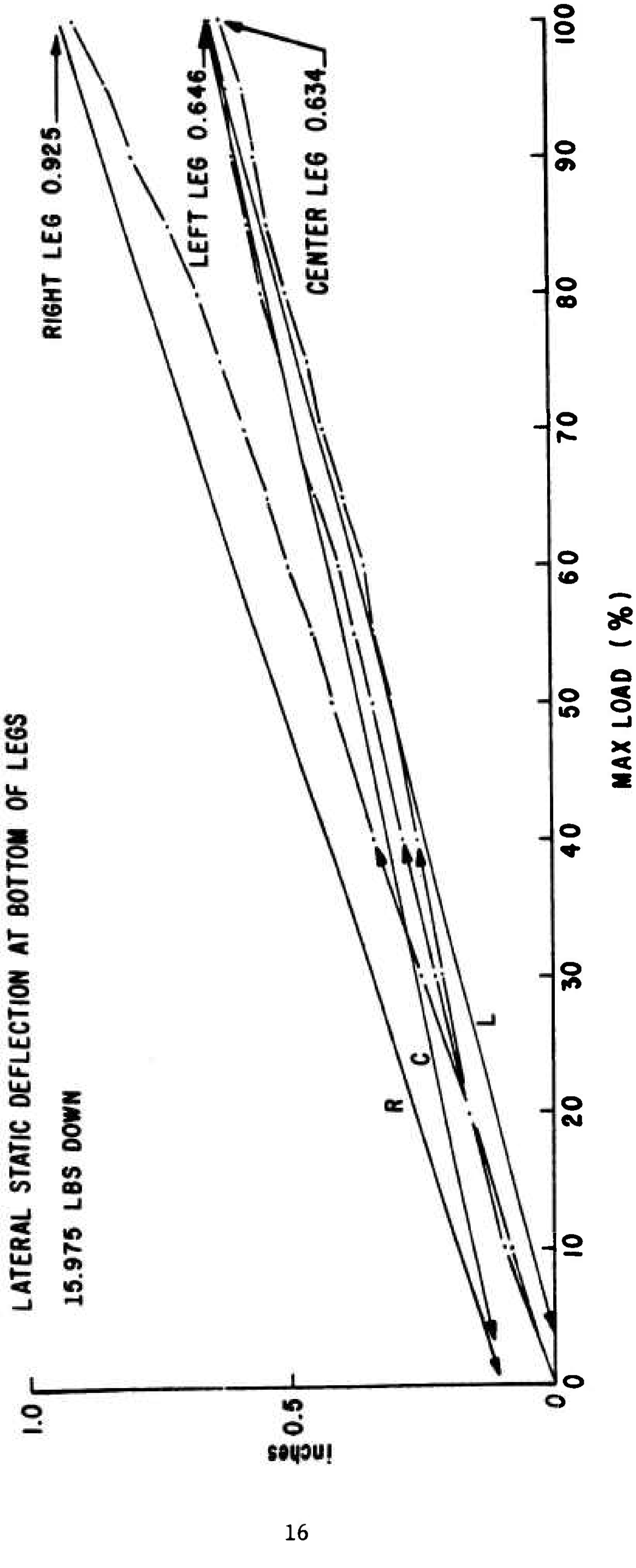

Figure 11. Condition No. 2

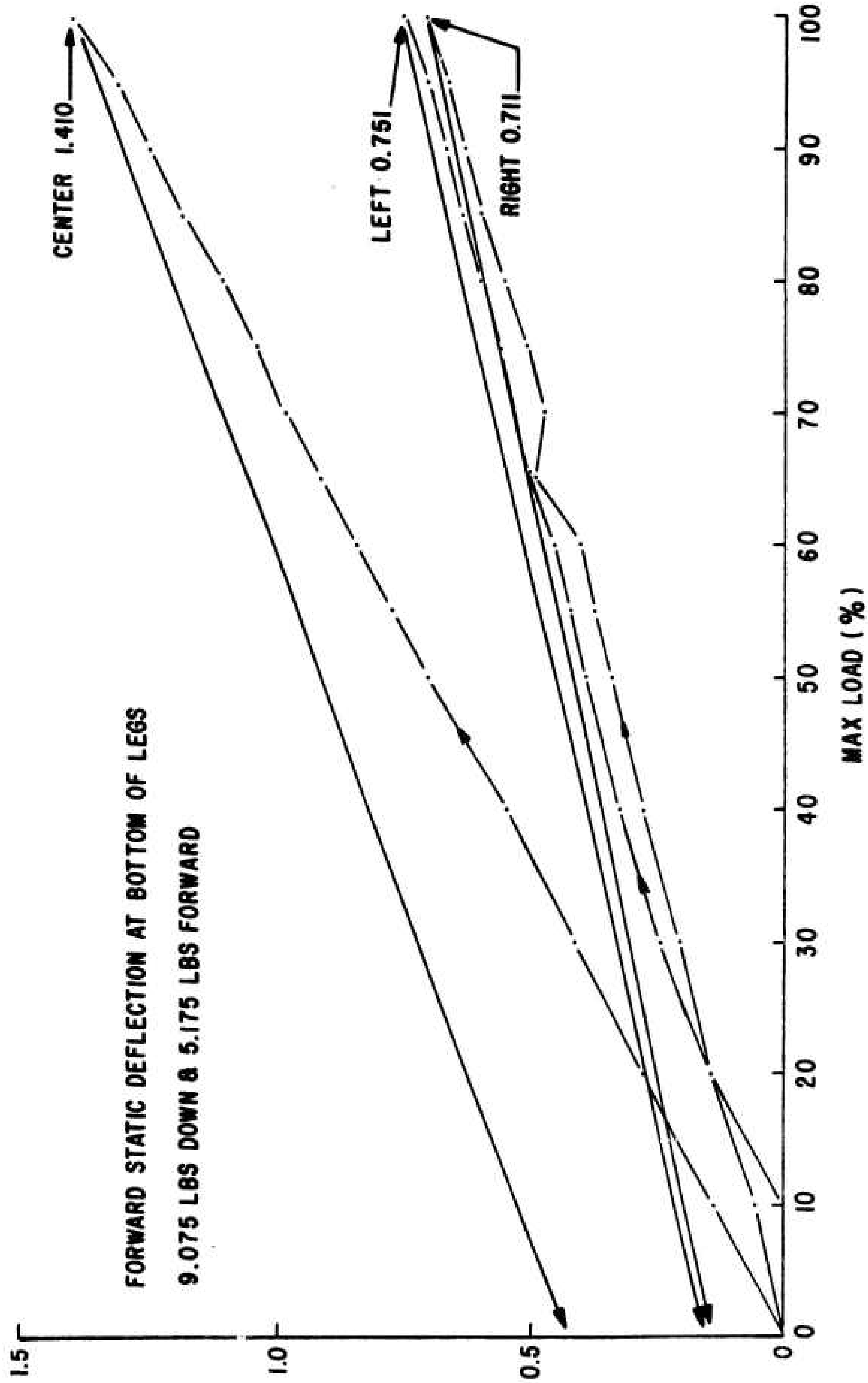

Figure 12. Condition No. 3

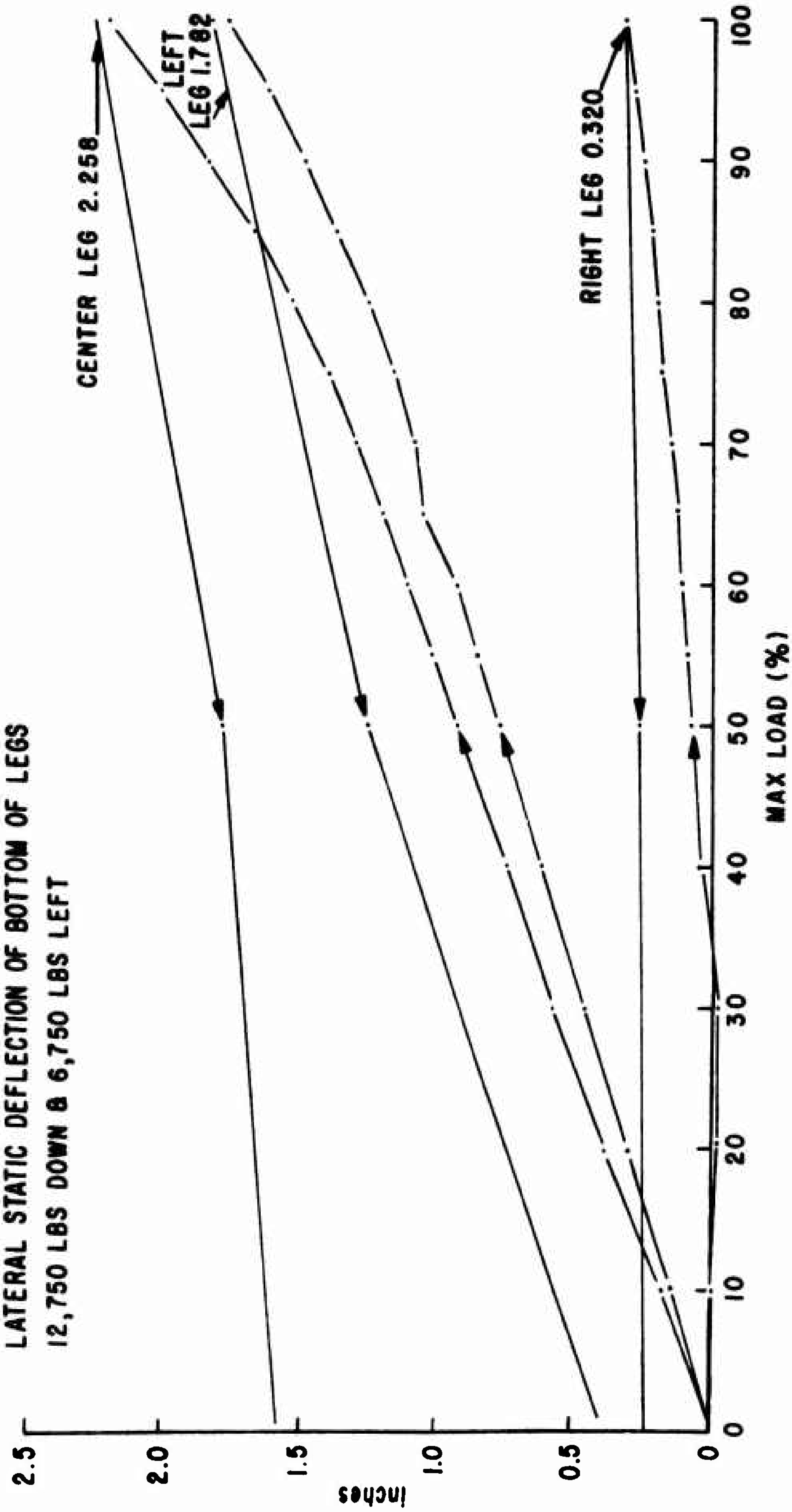

Figure 13. Condition No. 4

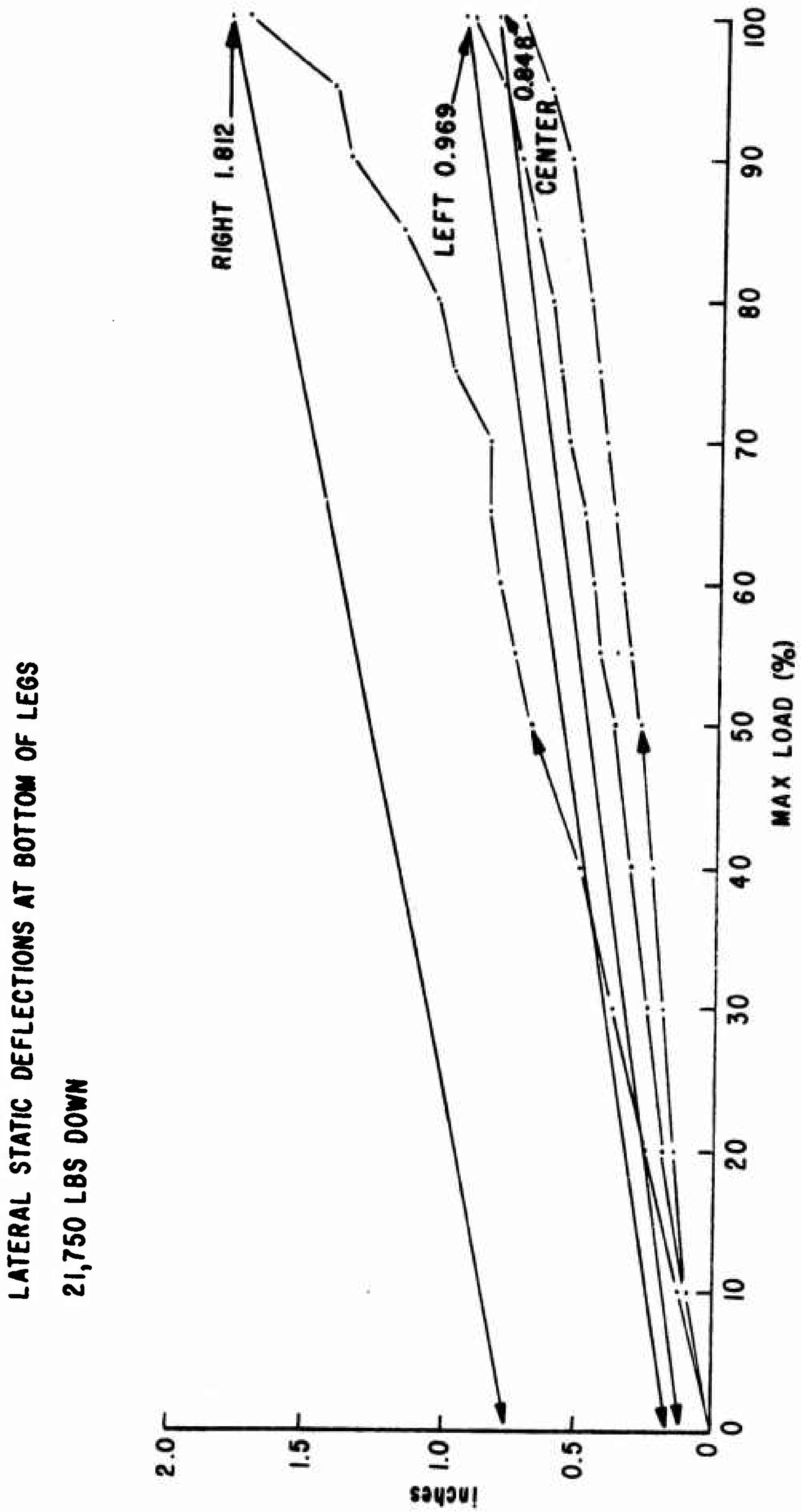

Figure 14. Condition No. 5

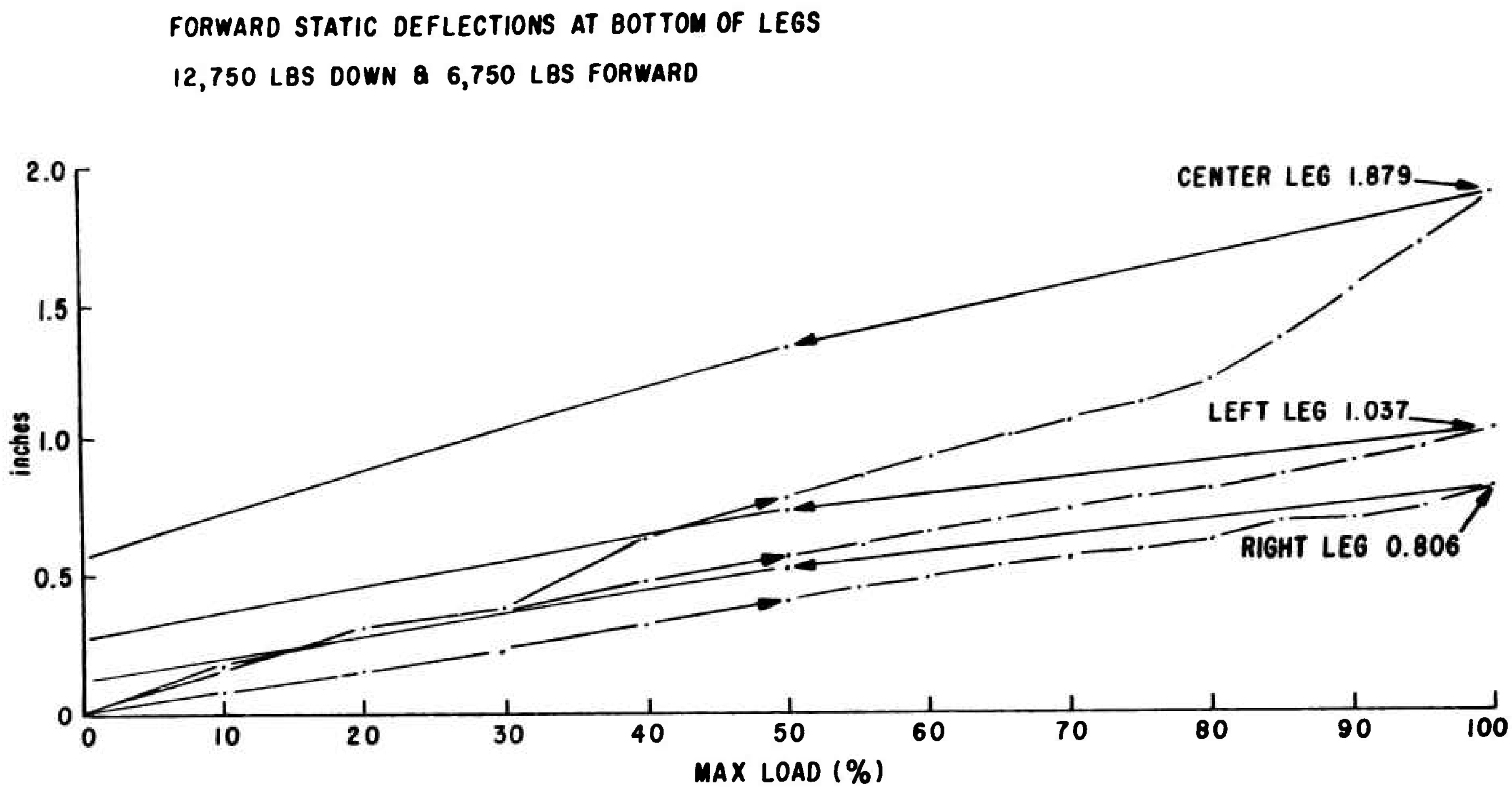

Figure 15. Condition No. 6

Table I

PERMANENT SET AS INDICATED BY DEFLECTION GAGE READINGS

Condition	Right Leg (in.)	Center Partition (in.)	Left Leg (in.)
1	0.026 left	0.586 left	0.286 left
2	0.100 right	0.114 left	0.022 right
3	0.138 forward	0.428 forward	0.157 forward
4	0.224 left	1.582 left	0.386 left
5	0.750 right	1.115 left	0.156 left
6	0.128 forward	0.573 forward	0.293 forward
Totals	0.430 right	3.397 left	0.806 left
	0.266 forward	1.001 forward	0.450 forward

Strain gage readings turned out to be relatively meaningless as compared with the deflection data. All strain readings were well within the elastic limit, were linear with load application, and returned to zero upon release of the loads. Thus, only data at the 100 percent load values for each condition are tabulated in table II.

Table II

MICROINCHES/INCH STRAIN

Gage	Condition 1 (Yield)	2 (Yield)	3 (Yield)	4 (Ult.)	5 (Ult.)	6 (Ult.)
1	+1044	+ 683	+ 202	+1298	+ 901	+ 372
2	+ 944	+ 571	+ 245	+1134	+ 738	+ 347
3	+ 483	+ 214	+ 248	+ 572	+ 299	+ 295
4	+ 260	+ 18	- 122	+ 331	+ 160	- 81
5	+ 383	+ 206	+ 44	+ 473	+ 366	+ 49
6	+1045	+ 644	+ 318	±1313	+ 896	+ 444
7	+ 986	+ 599	+ 222	+1266	+ 778	+ 316
8	- 105	+ 156	- 1	- 89	+ 275	- 28
9	- 205	+ 52	- 120	- 168	+ 205	- 163
10	- 162	+ 263	+ 265	- 74	+ 365	+ 339
11	- 361	- 596	- 314	- 442	- 700	- 437
12	*	*	*	*	*	*
13	*	*	*	*	*	*
14	+ 729	+1110	+ 664	+ 954	+1541	+ 927

*No data--gages destroyed in assembling test setup.

Positive strains are tensile; negative strains are compressive.

SECTION III

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSIONS

a. The MHU-79/C Clip-in exhibited more permanent deformation at the "yield" values than allowable, however, it is felt that the item is capable of carrying out its assigned mission because its design strength is so much greater than that of the carrier aircraft.

b. Strain gage data presented in this report are of little value since the gage locations did not coincide with the locations of inelastic behavior.

2. RECOMMENDATIONS

a. A simple method of loading stores into the clip-in should be devised. Interference and space limitation problems presently make loading very difficult.

b. Incorporation of some sort of sway brace system should be considered. The present design has the stores hanging loose on their shackles with no provision to restrain them in turbulence.

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Air Force Special Weapons Center (FTSE) Kirtland Air Force Base, New Mexico 87117	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP
3. REPORT TITLE MHU-79/C CLIP-IN STATIC TESTING	
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) 9 September through 10 December 1970	
5. AUTHOR(S) (First name, middle initial, last name) Mahlon E. Traylor, Jr.	

6. REPORT DATE March 1971	7a. TOTAL NO. OF PAGES 30	7b. NO. OF REFS 0
8a. CONTRACT OR GRANT NO. b. PROJECT NO. 5704 c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) AFSWC-TR-71-10 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	

10. DISTRIBUTION STATEMENT

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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY AFSWC (FTSE) Kirtland AFB, NM 87117

13. ABSTRACT

(Distribution Limitation Statement No. 3)

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UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
MHU-79/C						
Clip-in						
Static Test						

UNCLASSIFIED
Security Classification